REMARKS

Claim Rejections

Rejections Under 35 U.S.C. 102

The Examiner has rejected claims 19, 21 and 23-28 under 35 U.S.C. 102(e) as being anticipated by U.S. Patent No. 6,857,057, with inventors of Nelson et al. (hereinafter "Nelson").

Applicant respectfully submits that all of the claims of this application are patentable over Nelson. Nelson relates generally to providing point in time copies or snapshots of virtual storage volumes. Applicant respectfully submits that the description in Nelson has little to do with generating checkpoints for a virtual machine (VM), as claimed in this patent application.

With respect to claims 19 and 24, the Examiner wrote:

> Independent claim 19 and dependent claim 24 disclose; "maintaining, in an unmodified state, the contents of the virtual disk [maintaining the snapshot of the virtual disk, Figure 3] at the time for which the checkpoint is generated, while allowing the VM to continue using the virtual disk ["Write" operations, Figure 3]",
> "saving substantially all of the device state of the VM, at the time for which the checkpoint is generated, to a checkpoint data store [saving state of the primary VM to secondary VM via snapshot operation, Figure 3]",
> "marking the set of VM memory ["Memory" (Figure 1) providing a temporary storage area for the disks, Column 4, Line 20-21] as copy-on-write (COW) [snapshot operation, Figure 3], the set of VM memory constituting original VM memory",
> "allowing the VM to continue using the VM memory ["Write" operations, Figure 3]",
> "responding to memory COW faults related to the VM memory by generating copies of the original VM memory [snapshot operation, Figure 3] for read and write use by the VM [recovering the parent disk file by using the snapshot disk file, Column 1, Lines 37-39]" and
> "saving the original VM memory to the checkpoint data store [transferring the data

saved in the temporary memory to "storage space"
14, Figure 1]".

Applicant respectfully submits that claims 19 and 24 are patentable over Nelson for a variety of reasons. For example, claim 19 contains 3 references to "the time for which the <u>checkpoint</u> is generated" (emphasis added). Claim 19 also contains 3 references to a "<u>checkpoint</u> data store" (emphasis added). Applicant submits that it is clear from the description in this application that the term "checkpoint" refers to a checkpoint for a VM. Nelson makes no mention of a checkpoint for a VM or a checkpoint data store.

Also, claim 24 depends from claim 23, and therefore includes all of the limitations of the independent claim from which it depends. Accordingly, this claim is patentable for at least the same reasons as described herein for the respective independent claim from which it depends.

Nelson also does not disclose, nor suggest, "saving substantially all of the device state of the VM." With respect to this limitation, the Examiner wrote "saving state of the primary VM to secondary VM via snapshot operation, Figure 3." Applicant respectfully submits that the snapshot operation depicted in Figure 3 of Nelson has nothing to do with saving the state of a VM. Applicant does not understand how the citation made by the Examiner can be interpreted to disclose or suggest this limitation.

Nelson also does not disclose, nor suggest, "marking the set of VM memory as copy-on-write (COW)." Applicant respectfully submits that Nelson does not contain any memory that would be considered "VM memory," as that phrase would be understood by a person of skill in the art, based on the description in this application. With respect to this limitation, the Examiner wrote ""Memory" (Figure 1) providing a temporary storage area for the disks, Column 4, Line 20-21." Applicant respectfully submits that the memory 18 depicted in Figure 1 of Nelson would not be considered "VM memory" by a person of skill in the art. Also, applicant submits that there is no indication in Nelson that the memory 18 should be marked as copy-on-write, including memory that is used "to provide a cache for temporarily storing data."

Nelson also does not disclose, nor suggest, "allowing the VM to continue using the VM memory." With respect to this limitation, the Examiner wrote ""Write" operations,

Figure 3." Applicant respectfully submits that the Write operations depicted in Figure 3 of Nelson have nothing to do with allowing a VM to continue using VM memory. Applicant does not understand how the citation made by the Examiner can be interpreted to disclose or suggest this limitation.

Nelson also does not disclose, nor suggest, "responding to memory COW faults related to the VM memory by generating copies of the original VM memory for read and write use by the VM." With respect to this limitation, the Examiner wrote "snapshot operation, Figure 3" and "recovering the parent disk file by using the snapshot disk file, Column 1, Lines 37-39." Applicant does not understand how the citation made by the Examiner can be interpreted to disclose or suggest this limitation. Applicant again submits that there is no indication in Nelson that the memory 18 should be marked as copy-on-write. Also, applicant submits that there is no indication in Nelson that copies of the memory 18 should be generated in response to memory COW faults.

With respect to claims 21 and 27, the Examiner wrote:

> Claims 21 and 27 disclose, "the virtual disk is initially mapped to a parent disk file on a physical disk ["Storage Space" (RAID), Figure 1] and wherein the step of maintaining, in an unmodified state, the contents of the virtual disk comprises creating a copy-on-write (COW) disk file pointing to the parent disk [creating a snapshot disk (RAID, Column 3, Line 7) file, Element 42, Figure 3] and mapping the virtual disk to the COW disk file".

Claim 21 depends from claim 19 and claim 27 depends from claim 23. Each of these dependent claims includes all of the limitations of the independent claim from which it depends. Accordingly, each dependent claim is patentable for at least the same reasons as described herein for the respective independent claim from which it depends.

With respect to claim 23, the Examiner wrote:

> Independent claim 23 discloses; "maintaining, in an unmodified state, the contents of the virtual disk [maintaining the snapshot of the virtual disk, Figure 3] at the time for which the checkpoint is generated, while allowing the VM to continue using the virtual disk ["Write"

operations, Figure 3], the unmodified contents of the virtual disk constituting a checkpointed virtual disk [the "snapshot" copy 47, Figure 3], and the contents of the virtual disk used by the VM constituting an ongoing virtual disk [Element 40, Figure 3]",

"saving substantially all of the device state of the VM, at the time for which the checkpoint is generated, to a checkpoint data store [saving state of the primary VM to secondary VM via snapshot operation, Figure 3]",

"saving the contents of the VM memory, at the time for which the checkpoint is generated, to the checkpoint data store [transferring the data saved in the temporary memory to "storage space" 14, Figure 1], and allowing the VM to continue using the VM memory ["Write" operations, Figure 3], the contents of the VM memory saved to the checkpoint data store constituting a checkpointed VM memory [memory (18, figure 1) for the "snapshot" copy 47, Figure 3], and the contents of the VM memory as used by the VM constituting an ongoing VM memory [memory (18, Figure 1) in Element 40, Figure 3]" and

"allowing the VM to execute [transferring the data saved in the temporary memory to "storage space" 14, Figure 1] during at least a part of the time during which the checkpoint is being generated, and ensuring that the results of any pending disk writes are applied to both the checkpointed virtual disk and the ongoing virtual disk [transferring the data saved in the temporary memory to "storage space" 14, Figure 1], that the results of any new disk writes are applied to the ongoing virtual disk ["First Write" 49, Figure 3], but not to the checkpointed virtual disk, that the result of any pending disk reads are applied to both the checkpointed VM memory and the ongoing VM memory [reading the data saved in the cache, Column 4, Lines 20-23], and that the results of any new disk reads are applied to the ongoing VM memory [reading the data stored by the "First Write" (49, Figure 3)], but not to the checkpointed VM memory".

Applicant respectfully submits that claim 23 is patentable over Nelson for a variety of reasons. For example, as described above, claim 23 contains references to

"the time for which the <u>checkpoint</u> is generated" (emphasis added) and a "<u>checkpoint</u> data store" (emphasis added), which are not disclosed, nor suggested, by Nelson.

Also as described above, Nelson does not disclose, nor suggest, "saving substantially all of the device state of the VM."

Nelson also does not disclose, nor suggest, "saving the contents of the VM memory, at the time for which the checkpoint is generated, to the checkpoint data store." As described above, applicant respectfully submits that Nelson does not contain any memory that would be considered "VM memory," as that phrase would be understood by a person of skill in the art, based on the description in this application.

Also as described above, Nelson does not disclose, nor suggest, "allowing the VM to continue using the VM memory."

Nelson also does not disclose, nor suggest, "allowing the VM to execute during at least a part of the time during which the checkpoint is being generated." With respect to this limitation, the Examiner wrote "transferring the data saved in the temporary memory to "storage space" 14, Figure 1." Applicant respectfully submits that this citation has nothing to do with allowing a VM to execute while a checkpoint is generated. Applicant does not understand how the citation made by the Examiner can be interpreted to disclose or suggest this limitation.

Nelson also does not disclose, nor suggest, "ensuring that the results of any pending disk writes are applied to both the checkpointed virtual disk and the ongoing virtual disk." With respect to this limitation, the Examiner again wrote "transferring the data saved in the temporary memory to "storage space" 14, Figure 1." Applicant respectfully submits that this citation has nothing to do with "pending disk writes," as that phrase is used in this application. Applicant does not understand how the citation made by the Examiner can be interpreted to disclose or suggest this limitation.

Nelson also does not disclose, nor suggest, "[ensuring] that the results of any pending disk reads are applied to both the checkpointed VM memory and the ongoing VM memory." With respect to this limitation, the Examiner wrote "reading the data saved in the cache, Column 4, Lines 20-23." Applicant respectfully submits that this citation has nothing to do with "pending disk reads," as that phrase is used in this application. Applicant does not understand how the citation made by the Examiner can

be interpreted to disclose or suggest this limitation.

Nelson also does not disclose, nor suggest, "[ensuring] that the results of any new disk reads are applied to the ongoing VM memory, but not to the checkpointed VM memory." With respect to this limitation, the Examiner wrote "reading the data stored by the "First Write" (49, Figure 3)." Applicant respectfully submits that this citation has nothing to do with either ongoing VM memory or checkpointed VM memory. Applicant does not understand how the citation made by the Examiner can be interpreted to disclose or suggest this limitation.

With respect to claim 25, the Examiner wrote:

> Claim 25 discloses, "reissuing any pending disk reads for which the results of the read were directed to original VM memory [reading the data saved in the cache, Column 4, Lines 20-23] for which a COW fault has occurred, but directing the reissued disk reads to the corresponding copies of the original VM memory [reading the data saved in the cache (restored by the "snapshot" storage device), Column 4, Lines 20-23] instead of the original VM memory".

Claim 25 depends directly from claim 24 and indirectly from claim 23, and therefore includes all of the limitations of the claims from which it depends. Accordingly, this dependent claim is patentable for at least the same reasons as described herein for the claims from which it depends.

Nelson also does not disclose, nor suggest, "reissuing any pending disk reads for which the results of the read were directed to original VM memory for which a COW fault has occurred." With respect to this limitation, the Examiner wrote "reading the data saved in the cache, Column 4, Lines 20-23." Applicant respectfully submits that this citation has nothing to do with reissuing pending disk reads in this situation. Applicant does not understand how the citation made by the Examiner can be interpreted to disclose or suggest this limitation.

Nelson also does not disclose, nor suggest, "but directing the reissued disk reads to the corresponding copies of the original VM memory instead of the original VM memory." With respect to this limitation, the Examiner wrote "reading the data saved in the cache (restored by the "snapshot" storage device), Column 4, Lines 20-23." Again,

applicant respectfully submits that this citation has nothing to do with reissued disk reads. Applicant does not understand how the citation made by the Examiner can be interpreted to disclose or suggest this limitation.

With respect to claim 26, the Examiner wrote:

> Claim 26 discloses, "forcing COW faults for any original VM memory [reading the data saved in the cache (restored by the "snapshot" storage device), Column 4, Lines 20-23] that would otherwise be affected by the new disk reads".

Claim 26 depends directly from claim 24 and indirectly from claim 23, and therefore includes all of the limitations of the claims from which it depends. Accordingly, this dependent claim is patentable for at least the same reasons as described herein for the claims from which it depends.

Nelson also does not disclose, nor suggest, "forcing COW faults for any original VM memory that would otherwise be affected by the new disk reads." With respect to this limitation, the Examiner wrote "reading the data saved in the cache (restored by the "snapshot" storage device), Column 4, Lines 20-23." Applicant respectfully submits that this citation has nothing to do with forcing COW faults for original VM memory. Applicant does not understand how the citation made by the Examiner can be interpreted to disclose or suggest this limitation.

With respect to claim 28, the Examiner wrote:

> Claim 28 discloses, "if there is a pending disk write to the same COW block group as a subsequent write for which a disk COW fault has occurred, delaying responding to the disk COW fault and delaying the subsequent write until the pending disk write completes [transferring the data saved in the temporary memory (RAM, Column 4, Lines 18-25) to "storage space" 14, Figure 1] & [restoring the primary storage by using the snapshot storage]".

Claim 28 depends directly from claim 27 and indirectly from claim 23, and therefore includes all of the limitations of the claims from which it depends. Accordingly, this dependent claim is patentable for at least the same reasons as described herein for the claims from which it depends.

Nelson also does not disclose, nor suggest, "if there is a pending disk write to the same COW block group as a subsequent write for which a disk COW fault has occurred, delaying responding to the disk COW fault and delaying the subsequent write until the pending disk write completes." With respect to this limitation, the Examiner wrote "transferring the data saved in the temporary memory (RAM, Column 4, Lines 18-25) to "storage space" 14, Figure 1 & restoring the primary storage by using the snapshot storage." Applicant respectfully submits that this citation has nothing to do with this limitation. Applicant does not understand how the citation made by the Examiner can be interpreted to disclose or suggest this limitation.

Rejections Under 35 U.S.C. 103

The Examiner has rejected claims 1-13, 15-18, 20 and 22 under 35 U.S.C. 103(a) as being unpatentable over Nelson in view of U.S. Patent Application No. 2004/0010654, with inventors of Yasuda et al. (hereinafter "Yasuda"). Applicant respectfully submits that all of the claims of this application are patentable over Nelson in view of Yasuda.

With respect to claims 1. 20 and 22, the Examiner wrote:

> As per independent claim 1 and dependent claims 20 and 22, Nelson et al. disclose; "creating a copy-on-write (COW) disk file [creating a snapshot disk (RAID, Column 3, Line 7) file, Element 42, Figure 3] pointing to the parent disk file [Element 40, Figure 3] in use by the VM [Figure 2]",
>
> "marking the memory ["Memory" (Figure 1) providing a temporary storage area for the disks, Column 4, Line 20-21] of the VM copy-on-write [snapshot operation, Figure 3], the VM memory constituting original VM memory",
>
> "saving substantially all of the device state of the VM to memory [saving state of the primary VM to secondary VM via snapshot operation, Figure 3]",
>
> "switching the VM to use the COW disk file instead of the parent disk file [recovering the parent disk file by using the snapshot disk file, Column 1, Lines 37-39]",
>
> "handling disk COW faults to the COW disk file

[handling disk error by RAID operation, Column 3, Line 7]",
"handling memory COW faults to the original VM memory [handling disk error by RAID operation, Column 3, Line 7] to generate copies of the original VM memory [snapshot operation, Figure 3] for read and write use by the VM",
"saving the device state from memory to a checkpoint data store [transferring the state saved in the temporary memory to "storage space" 14, Figure 1]" and
"saving the original VM memory to the checkpoint data store [transferring the data saved in the temporary memory to "storage space" 14, Figure 1]".
Nelson et al. do not disclose expressly, "stopping the VM" and "resuming operation of the VM".
Yasuda et al. disclose temporarily stopping operation in a virtual network in paragraph 84.

Applicant respectfully submits that claims 1, 20 and 22 are patentable over Nelson combined with Yasuda for a variety of reasons. For example, claims 1 and 22 contain references to a "checkpoint data store" (emphasis added). As described above, applicant submits that it is clear from the description in this application that the term "checkpoint" refers to a checkpoint for a VM. Nelson and Yasuda make no mention of a checkpoint for a VM or a checkpoint data store.

Also, claims 20 and 22 depend from claim 19, and therefore include all of the limitations of the independent claim from which they depend. Accordingly, these claims are patentable for at least the same reasons as described herein for the respective independent claim from which they depend.

Nelson, combined with Yasuda, also do not disclose, nor suggest, "stopping the VM" or "resuming operation of the VM." With respect to this limitation, the Examiner wrote "Yasuda et al. disclose temporarily stopping operation in a virtual network in paragraph 84." Applicant respectfully submits that the disclosure in Yasuda has nothing to do with stopping a VM. Applicant does not understand how the citation made by the Examiner can be interpreted to disclose or suggest this limitation.

Nelson, combined with Yasuda, also do not disclose, nor suggest, "marking the

memory of the VM copy-on-write." Applicant respectfully submits that Nelson and Yasuda do not contain any memory that would be considered "memory of the VM," as that phrase would be understood by a person of skill in the art, based on the description in this application. With respect to this limitation, the Examiner wrote ""Memory" (Figure 1) providing a temporary storage area for the disks, Column 4, Line 20-21." Applicant respectfully submits that the memory 18 depicted in Figure 1 of Nelson would not be considered "memory of the VM" by a person of skill in the art. Also, applicant submits that there is no indication in Nelson that the memory 18 should be marked as copy-on-write, including memory that is used "to provide a cache for temporarily storing data."

Nelson, combined with Yasuda, also do not disclose, nor suggest, "handling memory COW faults to the original VM memory to generate copies of the original VM memory for read and write use by the VM." With respect to this limitation, the Examiner wrote "handling disk error by RAID operation, Column 3, Line 7" and "snapshot operation, Figure 3." Applicant does not understand how the citation made by the Examiner can be interpreted to disclose or suggest this limitation. For an earlier limitation related to VM memory, the Examiner cited the memory 18 of Nelson, but these citations relate to the storage space 14. Applicant respectfully submits that the single storage space 14 of Nelson does not disclose having both a disk file and a VM memory, as indicated in claim 1 of this application.

Nelson, combined with Yasuda, also do not disclose, nor suggest, "saving the device state from memory to a checkpoint data store." With respect to this limitation, the Examiner wrote "saving state of the primary VM to secondary VM via snapshot operation, Figure 3." Applicant respectfully submits that the snapshot operation depicted in Figure 3 of Nelson has nothing to do with saving the state of a VM. Applicant does not understand how the citation made by the Examiner can be interpreted to disclose or suggest this limitation.

With respect to claim 2, the Examiner wrote:

> Claim 2 discloses, "the VM is still running when the COW disk file is created [the VM running to create the COW]".

Claim 2 depends from claim 1, and therefore includes all of the limitations of the claim from which it depends. Accordingly, this dependent claim is patentable for at least

the same reasons as described herein for the claim from which it depends.

With respect to claim 3, the Examiner wrote:

> Claim 3 discloses, "copying the parent disk file after any pending disk writes complete [transferring the data saved in the temporary memory (RAM, Column 4, Lines 18-25) to "storage space" 14, Figure 1], and using the copy of the parent disk file for the checkpoint ["snapshot" copy, Figure 3]".

Claim 3 depends from claim 1, and therefore includes all of the limitations of the claim from which it depends. Accordingly, this dependent claim is patentable for at least the same reasons as described herein for the claim from which it depends.

Nelson also does not disclose, nor suggest, "copying the parent disk file after any pending disk writes complete." With respect to this limitation, the Examiner wrote "transferring the data saved in the temporary memory (RAM, Column 4, Lines 18-25) to "storage space" 14, Figure 1." Applicant respectfully submits that this citation has nothing to do with "pending disk writes," as that phrase is used in this application. Applicant does not understand how the citation made by the Examiner can be interpreted to disclose or suggest this limitation.

With respect to claim 4, the Examiner wrote:

> Claim 4 discloses, "committing the COW disk file into the original parent disk file [committing the "snapshot" disk file based on the original parent disk file (Restoring the original based on the snapshot), Column 1, Lines 24-40]".

Claim 4 depends directly from claim 3 and indirectly from claim 1, and therefore includes all of the limitations of the claims from which it depends. Accordingly, this dependent claim is patentable for at least the same reasons as described herein for the claims from which it depends.

With respect to claim 5, the Examiner wrote:

> Claim 5 discloses, "creating one or more new COW disk files [RAID mirroring, Column 3, Line 7] for use by the VM while the COW disk file previously used by the VM is being committed [creating "snapshot", Figure 3]".

Claim 5 depends directly from claim 3 and indirectly from claim 1, and therefore includes all of the limitations of the claims from which it depends. Accordingly, this dependent claim is patentable for at least the same reasons as described herein for the claims from which it depends.

With respect to claim 6, the Examiner wrote:

> Claim 6 discloses, "the copy of the parent disk file is indicated for use for the checkpoint by adding a disk file pointer to the checkpoint file [disk file pointers, Column 5, Lines 11-18]".

Claim 6 depends directly from claim 3 and indirectly from claim 1, and therefore includes all of the limitations of the claims from which it depends. Accordingly, this dependent claim is patentable for at least the same reasons as described herein for the claims from which it depends.

With respect to claim 7, the Examiner wrote:

> Claim 7 discloses, "the steps of creating the COW disk file and handling disk COW faults are performed by a data storage device that is external to the virtual computer system ["Host" 20, Figure 1]".

Claim 7 depends from claim 1, and therefore includes all of the limitations of the claim from which it depends. Accordingly, this dependent claim is patentable for at least the same reasons as described herein for the claim from which it depends.

With respect to claim 8, the Examiner wrote:

> Claim 8 discloses, "the step of saving the original VM memory to the checkpoint data store is delayed until all pending disk reads complete [completing disk reads assigned prior to the checkpoint operation]".

Claim 8 depends from claim 1, and therefore includes all of the limitations of the claim from which it depends. Accordingly, this dependent claim is patentable for at least the same reasons as described herein for the claim from which it depends.

Nelson also does not disclose, nor suggest, "the step of saving the original VM memory to the checkpoint data store is delayed until all pending disk reads complete." With respect to this limitation, the Examiner wrote "completing disk reads assigned prior

to the checkpoint operation." Applicant does not understand where the Examiner found the cited text or how the citation made by the Examiner can be interpreted to disclose or suggest this limitation.

With respect to claim 9, the Examiner wrote:

> Claim 9 discloses, "raw data store in a data storage medium [Figure 1]".

Claim 9 depends from claim 1, and therefore includes all of the limitations of the claim from which it depends. Accordingly, this dependent claim is patentable for at least the same reasons as described herein for the claim from which it depends.

With respect to claims 10 to 13, the Examiner wrote:

> Claims 10-13 disclose, "a file stored in a disk drive ["RAID", Column 3, Line 7]/high-speed random access memory [RAM, Column 4, Line 23]".

Claim 10 depends from claim 1, claims 11 and 12 depend directly from claim 10 and indirectly from claim 1, and claim 13 depends directly from claim 12 and indirectly from claims 10 and 1. Each of these dependent claims includes all of the limitations of the claims from which they depend. Accordingly, these dependent claims are patentable for at least the same reasons as described herein for the claims from which they depend.

With respect to claim 15, the Examiner wrote:

> Claim 15 discloses, "forcing memory COW faults on original VM memory [reading the data saved in the cache (restored by the "snapshot" storage device), Column 4, Lines 20-23] that is affected by any new disk reads, prior to issuing the new disk reads [any subsequent reads]".

Claim 15 depends directly from claim 1, and therefore includes all of the limitations of the claim from which it depends. Accordingly, this dependent claim is patentable for at least the same reasons as described herein for the claim from which it depends.

Nelson also does not disclose, nor suggest, "forcing memory COW faults on original VM memory that is affected by any new disk reads, prior to issuing the new disk reads." With respect to this limitation, the Examiner wrote "reading the data saved in

the cache (restored by the "snapshot" storage device), Column 4, Lines 20-23" and "any subsequent reads." Applicant respectfully submits that this citation has nothing to do with forcing COW faults on original VM memory. Applicant does not understand how the citation made by the Examiner can be interpreted to disclose or suggest this limitation.

With respect to claim 16, the Examiner wrote:

> Claim 16 discloses, "the resumption of the operation of the VM is delayed until all pending disk operations complete [transferring the main memory contents to the disk, Column 4, Lines 18-25]".

Claim 16 depends directly from claim 1, and therefore includes all of the limitations of the claim from which it depends. Accordingly, this dependent claim is patentable for at least the same reasons as described herein for the claim from which it depends.

Nelson also does not disclose, nor suggest, "if there is a pending read followed by a pending write to the same disk block, the resumption of the operation of the VM is delayed until all pending disk operations complete." With respect to this limitation, the Examiner wrote "transferring the main memory contents to the disk, Column 4, Lines 18-25." Applicant respectfully submits that this citation has nothing to do with this limitation. Applicant does not understand how the citation made by the Examiner can be interpreted to disclose or suggest this limitation.

With respect to claim 17, the Examiner wrote:

> Claim 17 discloses, "if the resumption of the operation of the VM is not delayed until all pending disk operations complete, reissuing any disk reads that affect any VM memory for which a COW fault has occurred [transferring the data saved in the temporary memory (RAM, Column 4, Lines 18-25) to "storage space" 14, Figure 1] & [restoring the primary storage by using the snapshot storage]"

Claim 17 depends directly from claim 16 and indirectly from claim 1, and therefore includes all of the limitations of the claims from which it depends. Accordingly, this dependent claim is patentable for at least the same reasons as described herein for

the claims from which it depends.

Nelson also does not disclose, nor suggest, "if the resumption of the operation of the VM is not delayed until all pending disk operations complete, reissuing any disk reads that affect any VM memory for which a COW fault has occurred." With respect to this limitation, the Examiner wrote "transferring the data saved in the temporary memory (RAM, Column 4, Lines 18-25) to "storage space" 14, Figure 1 & restoring the primary storage by using the snapshot storage." Applicant respectfully submits that this citation has nothing to do with this limitation. Applicant does not understand how the citation made by the Examiner can be interpreted to disclose or suggest this limitation.

With respect to claim 18, the Examiner wrote:

> Claim 18 discloses, "if there is a pending disk write to the same COW block group as a subsequent write for which a disk COW fault has occurred, delaying responding to the disk COW fault and delaying the subsequent write until the pending disk write completes [transferring the data saved in the temporary memory (RAM, Column 4, Lines 18-25) to "storage space" 14, Figure 1] & [restoring the primary storage by using the snapshot storage]".

Claim 18 depends directly from claim 1, and therefore includes all of the limitations of the claim from which it depends. Accordingly, this dependent claim is patentable for at least the same reasons as described herein for the claim from which it depends.

Nelson also does not disclose, nor suggest, "if there is a pending disk write to the same COW block group for which the disk COW fault has occurred, the handling of the disk COW fault and the write that caused the disk COW fault are delayed until the pending disk write completes." With respect to this limitation, the Examiner wrote "transferring the data saved in the temporary memory (RAM, Column 4, Lines 18-25) to "storage space" 14, Figure 1 & restoring the primary storage by using the snapshot storage." Applicant respectfully submits that this citation has nothing to do with this limitation. Applicant does not understand how the citation made by the Examiner can be interpreted to disclose or suggest this limitation.

The Examiner has rejected claim 14 under 35 U.S.C. 103(a) as being unpatentable over Nelson in view of Yasuda, and further in view of U.S. Patent No. 5,778,418, with inventors of Auclair et al. (hereinafter "Auclair"). Applicant respectfully submits that all of the claims of this application are patentable over Nelson in view of Yasuda, and further in view of Auclair.

With respect to claim 14, the Examiner wrote:

> As per claim 14, Nelson et al. and Yasuda et al. disclose the method recited in claim 12.
> Nelson et al. and Yasuda et al. do not disclose expressly, "flash memory".
> Auclair et al. disclose "flash memory" in column 1, at line 48.

Claim 14 depends directly from claim 12 and indirectly from claims 10 and 1. This dependent claim includes all of the limitations of the claims from which it depends. Accordingly, this dependent claim is patentable for at least the same reasons as described herein for the claims from which it depends.
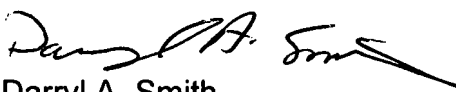
Conclusion

The various embodiments of the applicant's invention as defined in the various independent claims recite features that are not found at all in any of the cited references, whether the references are viewed independently or in combination. Accordingly, applicant submits that the independent claims are allowable over the cited prior art. The various dependent claims, of course, simply add additional limitations and should therefore be allowable along with their respective independent base claims. Applicant requests reconsideration of this application.

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Respectfully submitted,

3145 Porter Drive
Palo Alto, CA 94304
Phone: (650) 475-5157

Darryl A. Smith
Reg. No. 37,723
Attorney for the Applicant